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WINTER MORTALITY AMONG MULE DEER IN THE FISHLAKE NATIONAL FOREST, UTAH

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Explanatory Note

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WINTER MORTALITY AMONG MULE DEER IN THE FISHLAKE NATIONAL FOREST, UTAH [1]

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Wildlife technicians and administrators often have need for information concerning the extent of winter mortality in big game herds. The magnitude of winter losses directly affects the net increase or the numbers of deer available for hunter take. These losses may vary from a low of 5 percent or less, where predators are of little importance and good year-long forege and favorable winter conditions prevail, to a high of 50-65 percent where the ranges are extremely depleted and when an unusually severe winter occurs. Thus, Cliff (1939) cites the case of a deer herd in Oregon which suffered a 55 percent decrease in one winter. Taylor and Hahn (1947) likewise record an instance of a 65 percent herd reduction in one season for an area in the Edwards Plateau of Texas.

Methods which have been used to determine winter mortality are few. The one most commonly used on large areas is that of covering representative samples of the winter range after cessation of losses and recording the numbers of carcasses. The results from the samples are thus applied to larger units and the total estimated winter loss is then expressed as a percent of the herd which wintered on the area sampled. If the winter range is small it might be given a 100 percent coverage, but this is not practical for large areas. Taylor and Hahn (1947) not only made sample cruises but they also obtained an estimate of the winter loss by censusing the deer on the study unit before and after winter. The difference in the two population values would represent the winter loss.

The writer has made studies of the winter mortality in the deer herd of the Fishlake National Forest in central Utah during the period from 1939 to 1945. Prior to a discussion of the study a brief background description will be given to acquaint the reader with some of the factors contributing to the trend and extent of the winter losses. This forest embraces a gross area of 1,524,000 acres. It consists of north and south mountain ranges varying in elevation from 5,500 to 12,000 feet. During the winter the south exposures at the lower elevations are devoid of snow most of the time except for unusual winters or for short periods after snow storms. Snow may accumulate to a depth of 1-2 feet on the north exposures at elevations of 5,500 to 6,000 feet.

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[1] The writer is deeply indebted to Dr. George Hills Kelker, Professor of Wildlife Management at the Utah State College of Agriculture for reviewing the manuscript and offering many helpful suggestions.

However, from no snow or only a few inches at the lower elevations it increases in depth with altitude so that depths of 6-7 feet or more are found at 10,000 feet and above. Under such conditions the deer are normally forced down to elevations from 5,500 to 7,000 feet as early as December, and they remain at that altitude until mid-April or early May. Temperatures below zero are sometimes recorded at the wintering elevations but they occur only for short periods.

It became evident as early as 1929 that the deer were increasing at a rather rapid rate and were damaging the browse on some localized winter range units. Numbers pyramided rapidly during the 1930's. The limited number of does taken through hunting in 1934, 1935, and 1938 did little to curb the rapid increase. By 1938 extreme over-use of the browse on many areas was in evidence. The winter of 1938-39 was more prolonged and severe than usual, resulting in the death of thousands of deer from malnutrition on the concentration areas. The concentration areas made up but 25 percent of the entire winter range but 50-60 percent of the deer wintered on them. In these areas the utilization of the better browse plants such as bitterbrush,(Purshia tridentata), cliffrose,(Cowania stansburiana), true mountain-mahogany, (Cercocarpus montanus), and curlleaf mountain-mahogany,(C. ledifolius), had long been excessive. These browse plants had been badly hedged, high-lined or killed out by repeated close browsing. Even secondarily preferred species such as juniper,(Juniperus utahensis and J. scopulorum), sagebrush, (Artemisia tridentata), and pinyon pine, (Pinus edulis) (fig. 1) had been high-lined or, in the case of sagebrush, killed out where some of the heaviest concentrations existed. Thus the winter deer mortality of 1938-39, an estimated 20 percent of the entire herd, was the heaviest of any for which we have a record in the Fishlake Forest.

Subsequently, greater numbers of does were removed annually through hunting, until the peak removal of nearly 16,000 antlerless deer was made in 1942. The annual removals and estimated numbers of deer following each hunting season from 1939-45 are shown in Table 1. The reductions in herd numbers by hunting prevented catastrophic losses such as occurred with the Kaibab herd. A rather heavy loss occurred during the winter of 1940-41 but since that time excessive mortality has been restricted largely to localized areas. Due to herd reductions the browse on many of the former concentration spots has shown gratifying improvement so that now the problem areas are more restricted.

Two methods have been used to determine the extent of winter mortality in the Fishlake Forest. One of these has been the survey of sample plots. Thus in the spring of 1939, 4160 acres were surveyed in twenty-six 160-acre plots located in the concentration grounds. A total of 611 carcasses of deer that had died during that winter was found. As mentioned previously, the mortality was estimated at 20 percent of the herd. Similar sample area checks were made on localized areas in 1942 and 1944, but the results could not be applied forest-wide because an insufficient number of samples was taken. Conditions contributing to winter mortality vary considerably from one unit to another. Varying degrees of range depletion, predator density, poaching pressure, and other factors are found from unit to unit, necessitating a large number of samples being taken. These samples in turn must be weighted by

Figure 1.--A pinyon pine tree which has been high-lined by deer.

Table 1.--Deer Removals and Populations for the Fishlake National Forest, 1939-1945.

YEAR	REMOVALS			ESTIMATED POPULATION AFTER HUNT
	BUCKS	ANTLERLESS*	TOTAL	
1939	8,600	5,300	13,900	66,000
1940	11,000	7,600	18,600	69,000
1941	10,800	10,000	20,800	66,000
1942	12,300	15,700	28,000	56,000
1943	9,500	8,700	18,200	50,000
1944	8,400	6,200	14,600	45,000
1945	7,800	5,600	13,400	43,000
Total	68,400	59,100	127,500	

* Approximately 22 percent of the antlerless deer were fawns.

the area of the units for which they are representative. Thus, if a forest-wide loss determination is to be made from sample surveys, proper consideration must be given to variability of winter mortality. The number of areas which should be sampled is so large, and the resulting expenditure of manpower so great, that under normal conditions the sample cruise method of determining herd winter mortality for areas as extensive as the Fishlake herd's winter range is not practical, unless a cheap supply of labor is available. Thus in 1939 selected C.C.C. enrollees and E.R.A. men were available and under the supervision of technicians proved to be a valuable asset in this phase of the study.

When C.C.C. enrollees were no longer available the writer developed another means of determining winter mortality, and its use has been employed during the 5-year period from 1941-1945 inclusive. This method is a mathematical determination in which the loss ratios of the sex and age classes of dead deer are correlated with the sex and age classes of live deer in the herd before and after the period when winter losses of deer occur. It was found during the period of this study that fawn losses accounted for two-thirds of 486 carcasses which were classified as to sex and age (Table 2). The carcasses were seen by counters when the annual deer census was being made. Fawns made up but 39 percent of herd numbers at the onset of winter as determined by field classifications of 10,894 live deer by sex and age (Table 3), during November and December following the deer hunts each year of the 5-year period starting in 1940. The classification of carcasses and live deer clearly indicated a disproportionately heavier toll of fawns than of older deer. As a consequence, it could be expected that the percentage of fawns in the herd following winter would be less than it was before. If the fawn composition in the herd which survived winter is accurately measured, then the percentage of winter loss by age and sex classes can be readily determined mathematically. There are two methods by which the after-winter fawn composition can be determined. One way is to make field classifications of live

deer in late April and early May, at which time winter mortality has ceased. This, of course, entails additional field work, and some difficulty is experienced in distinguishing the large fawns from small yearlings. The second method of determining the surviving fawn fraction is to determine the age composition of the legal kill during the subsequent hunt. The fawns would then be yearlings, but yearlings can readily be distinguished from older deer through examination of their teeth (Cahalane 1932; Cowan 1936; Park and Day 1943; Rasmussen 1939; McLean 1936). The losses of deer during the summer are normally light except for the mortality in the current fawn crop. Also, the summer losses which do occur in yearlings and older deer are believed to be proportional so that the relationship between these two age groups does not change materially from the time winter mortality ceases in late April until the hunting season in late October.

The writer believes legally-killed does offer a more representative cross-section of age classes in the herd than the legally-killed bucks. This belief is supported by the fact that most buck hunters try for the large, mature bucks rather than the small yearlings. This factor of selectiveness by the hunter makes it improbable that the age classes of bucks in the legal kill are representative of the herd. It is believed that selectivity of age classes by the hunter in taking does is at a minimum. There is less distinction in size between the two age groups in does than there is with bucks, and in addition does offer no trophy incentive to the hunter. However, it is true that hunters prefer "dry" does over "wet" does. It is also true that essentially all mule deer yearling does in central Utah are dry or have had no fawns. It might be reasoned, therefore, that hunters would take proportionately more yearling does than older does. However, in the field, yearling does are not readily distinguishable from older ones. Many hunters are not even able to distinguish 4-month old fawns from does. Yearling does are almost always found with other does and their fawns, thus making it difficult for the hunter to determine which are the "dry" yearling does in the brief time which he has to observe them before shooting. It is believed that when large numbers of doe deer are taken by hunters, as has been the case on the Fishlake Forest during the period of the study, the importance of selective killing of does is inconsequential, or at least greatly minimized. Age classifications of does at checking stations have been obtained as a regular part of deer studies being conducted on the Fishlake Forest. Consequently, no additional effort was needed as would have been the case if field classifications of deer had been necessary immediately following the period when winter mortality occurs.

The post-hunt field classifications of live deer in November and December (Table 4) have shown that female fawns have made up 30 percent of all females as an average for the 5-year period. This assertion is based on the assumption that half of the fawns are females. Classification of legally killed does during the subsequent hunting seasons showed that yearling does made up 27.4 percent of the does (Table 5). The drop from 30.0 percent to 27.4 percent has resulted primarily because of the differential toll which winter mortality took of the fawns and of the older deer. One might reason that the overwinter percentage in loss of fawns could be determined merely by dividing the difference between 30.0 percent and 27.4 percent, or 2.6 percent by 30.0 percent, giving a mortality of 8.7 percent. This would be a close approximation if no loss occurred in the older age classes. The fact that there is some mortality

in the other age groups makes an algebraic calculation necessary in order to determine the percentage of winter loss of fawns, bucks, and does, as well as the herd loss.

Table 2.--Sex and Age Classifications of Dead Deer Found During the Five Winters from 1940-1941 through 1944-1945 in the Fishlake National Forest.

Winter	Bucks	Does	Unclassified Mature*	Fawns	Total
1940 - 41	2	19	--	41	62
1941 - 42	8	32	--	98	138
1942 - 43	11	27	--	60	98
1943 - 44	5	27	7	108	147
1944 - 45	8	15	1	17	41
Total	34	120	8	324	486

* Values in this column are broken down for calculation purposes in Table 3 in the same proportion as the buck and doe losses and assigned accordingly to the buck and doe columns.

Table 3.--Loss Ratios of Dead Deer Listed in Table 2.

Winter	Bucks	Does	Fawns	Female Fawns*
1940 - 41	0.11	1.00	2.16	1.08
1941 - 42	0.25	1.00	3.06	1.53
1942 - 43	0.41	1.00	2.22	1.11
1943 - 44	0.18	1.00	3.33	1.67
1944 - 45	0.53	1.00	1.09	0.54
Mean	0.30	1.00	2.37	1.19

* The sex ratio of the fawns is considered to be even.

Table 4.--Ratios of Sex and Age Classes of Live Deer in the Fishlake Herd Following the Deer Hunt for Each Year from 1940 through 1944.

Year (Nov. & Dec.)	Number Deer Classified	Ratio of Live Deer with Bucks as Base			
		Bucks	Does	Fawns	FemaleFawns
1940	2,625	100	339	320	160
1941	3,086	100	335	298	149
1942	2,529	100	260	222	111
1943	1,089	100	315	266	133
1944	1,565	100	289	214	107
Total & Mean	10,894	100	308	264	132

Table 5.--Age Classifications of Does Taken During the Hunting Seasons from 1941 through 1945 on the Fishlake Forest.

Year	Number Does Classified		Total	Percent Yearlings
	Mature(2-years and over)	Yearlings		
1941	1,704	676	2,380	28.4
1942	568	225	793	28.4
1943	265	104	369	28.2
1944	172	60	232	25.9
1945	160	57	217	26.3
Totals & Mean	2,869	1,122	3,991	27.4

The letter d will be set up as equalling the average number of does which died during the winter for each sample of 308 does that were present in the herd at the beginning of winter, excluding the female fawns (Table 4). There were 1.19 female fawns dying for each doe that died during the period of the study (Table 3). Therefore 1.19 times d equals the number of female fawns dying out of each sample of 132 female fawns entering the winter for each sample of 308 does. Consequently d plus 1.19d or 2.19d equals the total loss of female fawns and does for each sample of 440 females in the herd at the start of winter (308 does plus 132 female fawns). The number of female fawns dying during the winter subtracted from the number going into winter necessarily gives the number that survives. On the basis of the sample, 132 minus 1.19d equals the surviving sample of female fawns. The surviving sample of all females would be 440 minus 2.19d. The sample buck loss would be 0.30 times d and the total fawn loss would be 2.37 times d, for each sample of 264 fawns entering the winter (Table 3 and Table 4). One other value is used in the calculation and that is 0.274, which is the decimal fraction of female fawns to all females after winter had taken its toll, or more appropriately, the fraction of yearling does of all does in the herd during the subsequent hunting season.

From the foregoing a word equation can be set up:

$$\frac{\text{female fawns surviving winter}}{\text{all females surviving winter}} = \text{yearling doe fraction in herd during following hunting season}$$

The same equation expressed algebraically would be:

$$\frac{132 - 1.19d}{440 - 2.19d} = 0.274$$

Solving for d:

$$132 - 1.19d = 120.56 - 0.60d$$

$$0.59d = 11.44$$

$d = 19.4$ - doe loss per sample of 308 or 6.3%

$0.30d = 5.8$ - buck loss per sample of 100 or 5.8%

$2.37d = 45.7$ - fawn loss per sample of 264 or 17.3%

Adding, 70.9 = dead deer per sample of 672 entering winter or herd loss of 10.6%

The value 10.6 percent is the calculated average winter loss for the 5-year period of this phase of the study. Similar calculations to determine the herd loss for each winter have given the following results:

Winter	Herd Winter Loss (percent)
1940-41	15.9
1941-42	8.4
1942-43	7.9
1943-44	11.5
1944-45	8.2

General Discussion of Results of Study and Factors Affecting Winter Mortality of Deer.

The average winter mortality of 10.6 percent, as determined above, included some losses from malnutrition which occurred on some units each year

of the study. Increased starvation losses accounted for the greater loss values recorded for the herd for the winters of 1940-41 and 1943-44 when estimated losses of 15.9 and 11.5 percent occurred respectively. Because some losses from malnutrition resulted each year of the study it is felt that a herd on properly stocked ranges under Utah conditions should not lose more than 5 percent of its numbers over winter. This statement is made on the premise that the coyotes and mountain lion populations will be controlled. Doman and Rasmussen (1944) report a loss of not over 5 percent on some winter range areas in northern Utah during the winter of 1942-43 when a loss of 22 percent was recorded for the herd wintering on the nearby Logan - Green Canyon area which was extremely depleted.

In addition to some malnutritional losses the 10.6 percent also includes the kills made by a sizeable population of coyotes and mountain lions which were present in and adjacent to the Fishlake Forest. The estimated mountain lion population was between 100 and 200 animals and unquestionably this number of lions was responsible for taking quite a number of deer each winter. The close of the war has seen a number of lion hunters returning to the sport of lion hunting and this factor, in addition to a $25.00 bounty, should result in a closer control of mountain lion numbers.

It has been noted that most starvation losses in the Fishlake herd have occurred in late March and early April. This is the time when the deer are at their weakest just before the new spring growth of forage comes in sufficient quantities to permit weight gains. These observations corroborate those of Harris (1945) for deer in North Dakota.

Winter mortality probably exceeds that of any other season. Two exceptions to this statement might well be fawn losses soon after they are dropped and losses incurred during the hunting season. Deer in the northern half of the United States are subject to at least three or four months in which below freezing temperatures and snowfalls occur. The snow in varying degrees hampers the movements of deer, restricting their daily cruising radius and making much of the forage unavailable or difficult to obtain. Another handicap is that the winter browse is much lower in proteins and carbohydrates than summer forage (Hellmers, 1940; Einarsen, 1946), which makes it even more difficult for deer to obtain sufficient nutrients to maintain their body weights. Freezing temperatures increase the metabolic rates of the deer because of the increased dissipation of heat from the surface of the animal. This condition frequently results in weight losses, because the dissipation of heat exceeds the production of energy from food taken in.

Gerstell (1937) discovered from feeding immature deer that they lost from 3 to 12 pounds per week per hundred pounds of body weight when the average mean temperatures were considerably below freezing. The weight losses occurred regardless of the amount and quality of foods offered. Doman and Rasmussen (1944) have given 30 percent as the approximate maximum weight loss that deer can sustain and be expected to survive. Therefore, prolonged periods of cold and heavy snow may result in heavy mortality of the weak deer. In addition, the losses from predators and disease are probably greater in winter than during the other seasons because of the weakened condition of the deer and unavailability of many other prey species.

It has been noted by many wildlife observers that fawns are subject to a heavier winter mortality than older deer (Gerstell 1937; Harris 1945; Doman and Rasmussen 1944; Taylor and Hahn 1947; Feeney 1942; Colorado Game and Fish Department 1940; and others). Thus, from the Fishlake study, the winter losses of bucks and does, 5.8 and 6.3 percent respectively, are very nearly the same, but fawn losses of 17.3 percent were nearly three times the loss rate of the older deer. Fawns have never undergone the "survival-of-the-fittest" test which winter imposes upon animals. The rigors which winter introduces tends to eliminate the weak and unfit. Hence, aged individuals and fawns should comprise the bulk of the winter losses. In areas where hunting pressure is sufficiently great to limit the numbers of animals reaching over-maturity, fawns will probably account for most of the winter mortality. A few exceptions have been noted in the literature; Olsen (1938) reports that fawns made up but 25 percent of the winter loss on an area in Minnesota.

Kelker (1945) has shown through the use of Meeh's formula that a fawn weighing half as much as a buck has a surface area two-thirds as great. Heat dissipation is dependent upon the surface area, but production of heat is proportional to the bulk of the animal. As a consequence, fawns would be the first to succumb from cold through a faster depletion of stored body energy.

Morrison (1939) stated that the gains of young animals are more watery than those of older ones and also contain more protein and far less fat, which has a higher heat value than protein. It has been the observation of the writer that fawns go into the winter with little stored fat. Many fawn carcasses have been examined, both hog-dressed and skinned out, during the period from October through December. Invariably they have little stored fat in the body cavity and essentially none on the hips and rump. This condition is in marked contrast to most of the older deer during the same period and would further explain the heavier mortality of fawns. In addition, fawns are probably subjected to a heavier loss from coyote predation because of their smaller size. Other reasons for heavier mortality in the immature animals are that they are unable to browse as high or digest as coarse material as older deer.

Further observations have revealed a rough correlation of fawn losses with severity of weather and range depletion; the more severe the greater the percentage of fawns in the total loss. Thus, in the critical winter of 1938-39, fawns made up 76 percent of the 611 dead deer encountered on the winter mortality surveys (fig. 2). This was the severest winter and also the highest percent of dead fawns which has been recorded for the entire Fishlake Forest in seven years of study. During this same winter fawns made up 80 percent of the dead deer found on the winter range near Annabella, Utah. This was the most depleted of any range on or adjacent to the forest in that year. During the mild winter of 1944-45 immature deer made up but 41 percent of the dead deer recorded. On a winter mortality survey in Twelve-Mile Canyon, a localized area of extreme range depletion on the adjacent Manti National Forest, in May 1944, following a winter of above average severity, the writer and a state game warden found 21 dead deer on 190 acres. Eighteen, or 86 percent, of the 21 deer were fawns when an estimated herd loss of between 20 and 25 percent occurred.

Doman and Rasmussen (1944) reported a 16 percent herd loss for deer wintering in the overbrowsed Logan-Green Canyon area in northern Utah during the

Figure 2.--Fawns made up 76 percent of the winter loss in the Fishlake Forest during the winter of 1938-39.

winter of 1941-42. Fawns constituted 85 percent of the loss. During the following winter mortality to the extent of 22 percent of the herd occurred and fawns made up 93 percent of the 119 recorded dead deer.

A practical application for winter loss data by sex and age classes is in the calculation of the following summer's sex ratio and surviving population of deer. The sex ratio of the summer herd is essential information in the event use is made of the sex ratio method of censusing deer (Kelker 1940; 1944). Briefly, this method is a mathematical calculation of herd numbers in which the pre-hunt or summer sex ratio, a classification of deer killed during the hunt and the post-hunt sex ratio, are the necessary data. A weakness in the field application of this method is the difficulty experienced in some areas in classifying an adequate and accurate sample of the deer herd during the summer, from which the pre-hunt sex ratio is derived. It is sometimes difficult to obtain an adequate sample because of the wide dispersal of the deer and the dense foliage of deciduous shrubs and trees throughout the summer. The paramount difficulty encountered, however, is in obtaining a representative sample because of the tendency for bucks to bunch up together at the higher elevations. Frequently these higher elevations have sparse cover so the bucks can be easily seen. At intermediate elevations, where most of the does and fawns are found, cover is usually more dense. This makes it much easier to count bucks than does and fawns. Post-hunt classifications, on the other hand, are obtainable with much less effort and with a greater chance of accuracy, for they are obtained normally during the mating season when bucks are well dispersed with the does, and at a time when deer are more concentrated and have a minimum of cover in which to escape detection.

A summer herd sex ratio can be readily calculated by using the post-hunt classification records of the preceding late fall or early winter and the winter loss percentages for bucks, does, and fawns. Thus, if 300 bucks, 1,000 does, and 800 fawns were classified prior to winter, and winter mortality of 5.8, 6.3 and 17.3 percent occurred respectively in the three classes of animals, the expected loss for the classified herd sample would be 17 bucks, 63 does and 138 fawns. The numbers surviving winter would consequently be 238 bucks, 937 does and 662 fawns. If an even sex ratio in the fawns is assumed, 331 males and a like number of females would be added to the mature deer, giving a total of 614 bucks and 1268 does as entering the summer. Consequently, the expected summer sex ratio would be 1:2.07. Before this value can be used in calculating herd numbers, however, the kill must be determined for the subsequent hunt, and another set of post-hunt classifications obtained. Some administrators and wildlife students determine the summer sex ratio in the manner outlined above except that they do not recognize that there is probably a differential winter loss in the age classes. In other words, their determination is made by dividing the post-hunt fawn sample evenly and adding each half to the mature buck and mature doe samples. If such reasoning had been followed above, the original 800 fawns would have added 400 to the 300 bucks and 400 to the 1,000 does, giving a sex ratio of 1:2.00 from the resulting 700 bucks and 1,400 does. To many this ratio may seem sufficiently close to 1:2.07 so that the difference could be considered inconsequential. However, in using the sex ratio method of census, this seemingly slight difference is magnified considerably. This is especially true where the spread in the pre-hunt and post-hunt ratios created through differential hunting removals in the sexes is very small. If the post-hunt sex ratio is nearly 1:1, or if winter mortality in a deer herd is found to be very small or that which occurs is proportional among the sex and age classes, then the summer sex ratio could safely be determined without applying the winter loss percentages.

Of interest, perhaps, is the sex ratio of the dead fawns that have been found on the winter ranges. A record of sex has been obtained for only 332 fawns in the Fishlake Forest. Of this number, 166 were males and 166 were females for an even 1:1 ratio. However, a record of 347 sexed fawns on other ranges in Utah gave 169 males to 178 females for a ratio of 95:100. The sex ratio of the entire 679 fawns found dead on Utah winter ranges is 97:100. Colorado personnel (Colorado Game and Fish Commission, 1940), in sexing 1253 fawns which died on the depleted winter range of the Sapinero district during the winters of 1938-39 and 1939-40, found that males comprised slightly more than half for a ratio of 101:100. Hunting kill data indicate a slight preponderance of male fawns in the herd when the average fawn is about 4 months of age. In the Fishlake Forest a total of 2,160 fawns have been sexed during the October hunting season. The sex ratio was found to be 102:100. The sex ratio of 143 fawns which have been ear-tagged when only a few days old in the Fishlake Forest was 101:100. This is contrary to findings in Pennsylvania where Gerstell (1936) reported a sex ratio of 1 male to 2 female fawns for fawns killed during the 1935 hunting season. On the most depleted ranges he reported that female fawns made up as much as 80 percent of the total number of fawns. In the Fishlake Forest 239 fawns were sexed during the 1939 hunting season following the winter in which the severest loss took place, and of this number 51 percent were males.

Summary

A five-year winter deer mortality study was conducted by the writer in the Fishlake National Forest in central Utah while employed by the U. S. Forest Service as a wildlife technician. During the period 1940-1945 the study showed that an average annual winter herd loss of 10.6 percent occurred. The buck and doe loss was found to average 5.8 and 6.3 percent respectively, but the fawn loss was found to be 17.3 percent or almost three times greater than that of the older deer. A number of reasons are discussed as to why fawn losses are heavier than older deer. The sex ratio of fawns in the Fishlake Forest was found to be very nearly even. This applied not only to fawns killed during the hunting season but to those found dead on the winter range.

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